

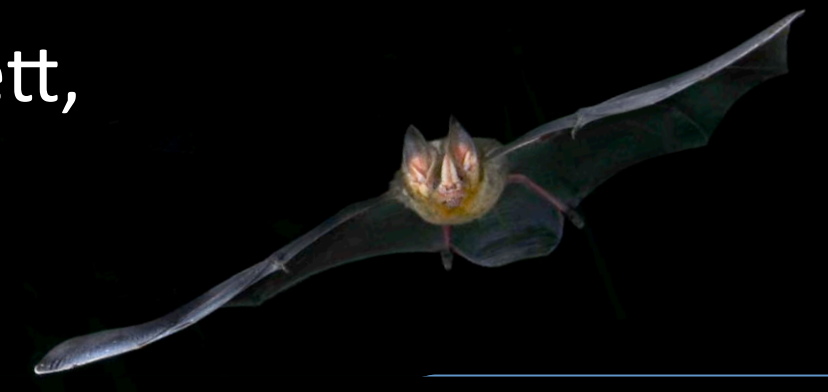
The Clare Lab: DNA and Ecological Networks, the Community Barcode Approach

Elizabeth L Clare, Hernani Oliveira, Tiago Teixeira, Dave Hemprich-Bennett,
Omar Khalilur Rahman, Rosie Drinkwater

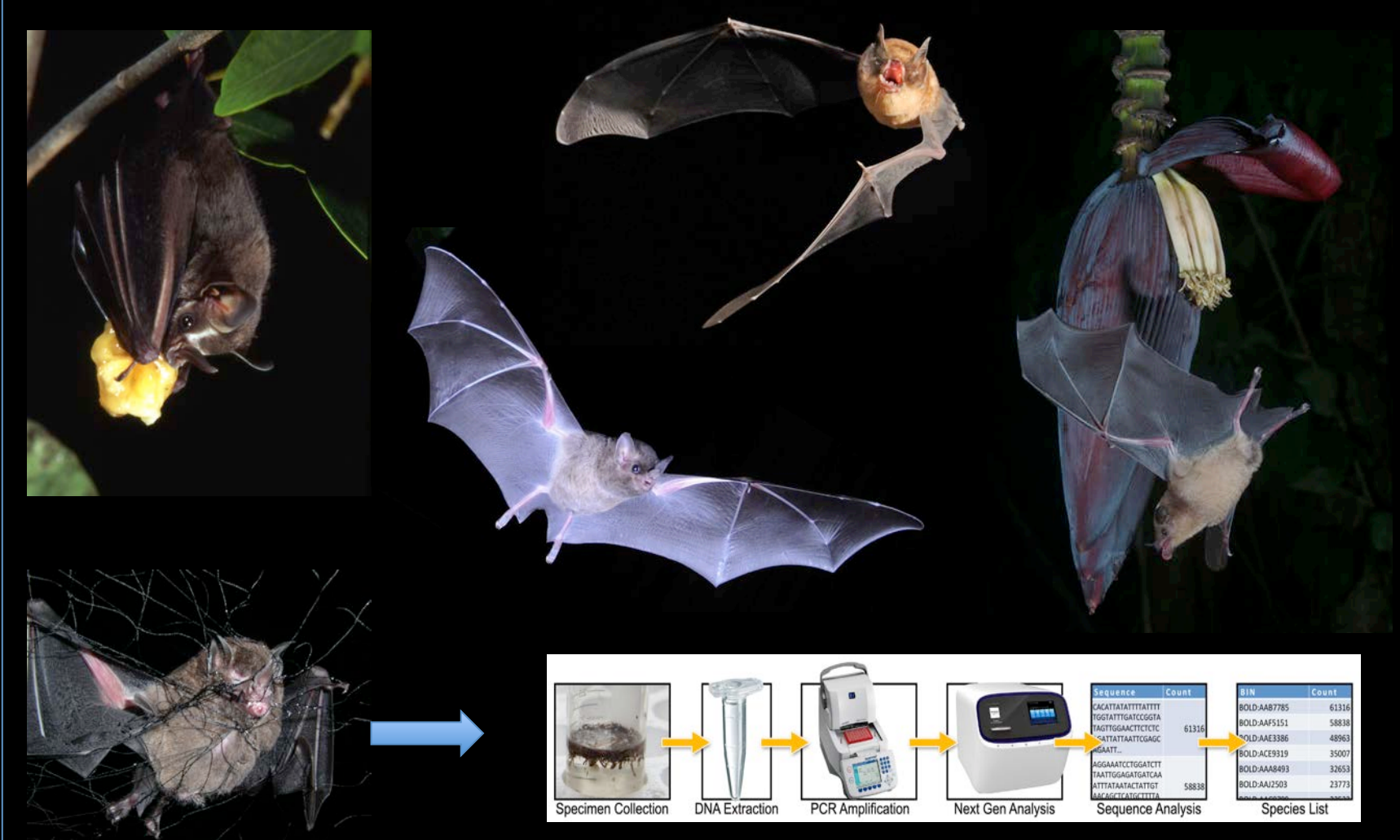
Abstract

A novel method for understanding interactions between species and the study of ecosystems dynamics.

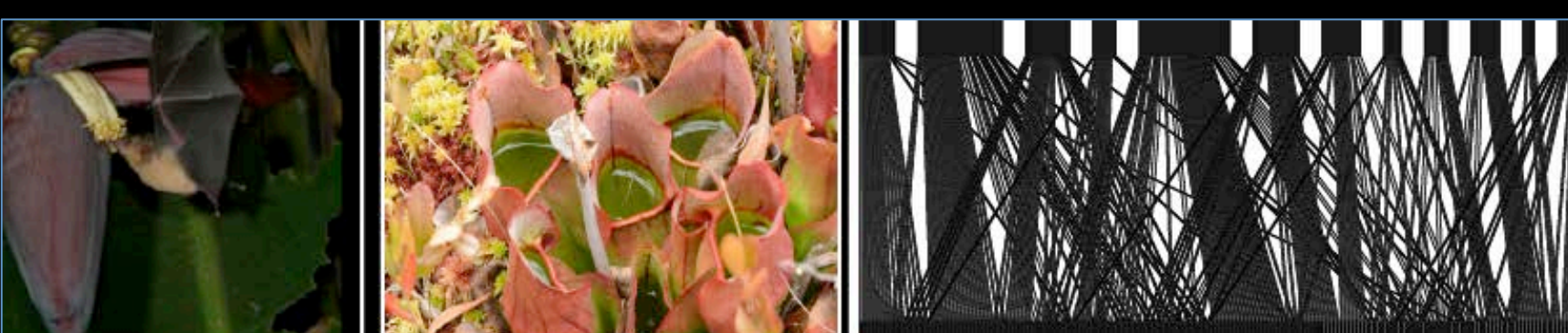
We catch animals in the wild and collect sources of eDNA - pollen, seeds and gut contents. These are taken back to the lab for DNA extraction, PCR and next generation sequencing. Our field sites are in Borneo, Jamaica, Texas, Costa Rica, Belize and Brazil. We also have ongoing projects related to carnivorous plants, solitary bees, marine foraging bats and technology development.



Studying Ecosystem Interactions with DNA



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We use DNA to link species together and the resulting interaction matrices are turned into networks (food webs) where horizontal bars or nodes represent taxa scaled for sample size and the lines between them depict the frequency of the interaction.

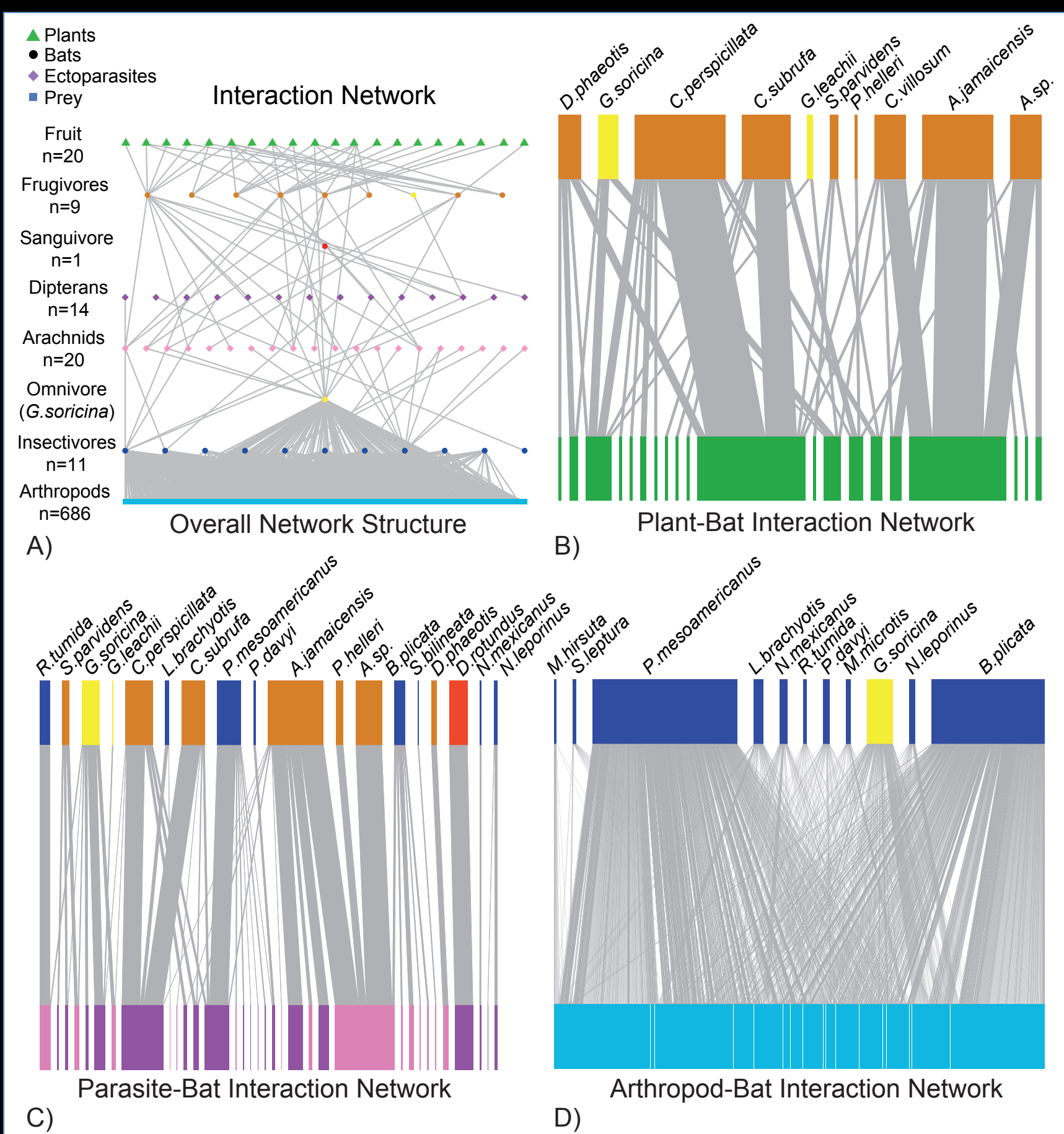


Figure 1: An interaction "network of networks" constructed for a bat community in Costa Rica using eDNA

Ecological interactions leave behind environmental DNA (eDNA) which can be recovered by sequencing and used to reconstruct the original event. These interactions can be used to construct networks and "networks of networks" (A). This reconstruction contains more than 3300 interactions between bats and plants (B) and bats and their parasites (C) resolved using full length barcodes and bats and insects (D) resolved using metabarcoding of short fragments.

Lab members and their work



Hernani Oliveira (BSc Brasília, MSc Brasília)

I am studying the effects of severe droughts and floods provoked by a strong El Niño event on the interactions between frugivorous and insectivorous bats and their food items in the dry forests and rainforests of Costa Rica. I am using DNA barcodes to reveal the interactions and network analysis to understand the magnitude of the changes witnessed.



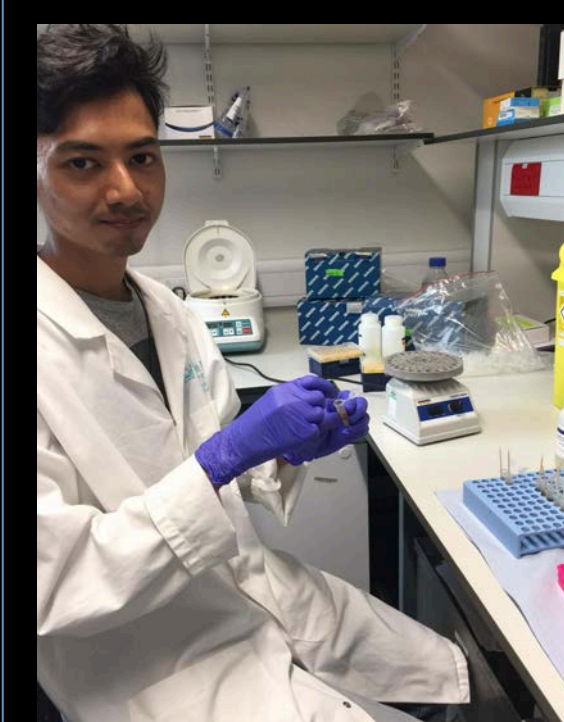
Dave Hemprich-Bennett (BSc Plymouth, MRes Bangor)

For my PhD I investigate the impacts of tropical rainforest degradation on bat assemblages and their prey. I study various areas in Sabah, Malaysia, capturing bats with harp traps and flying insects with malaise traps. I construct food webs to analyse differences between habitat degradation types. I also study the way OTUs are defined and its impacts on food web construction.



Tiago Teixeira (BSc Rio de Janeiro, MSc Rio de Janeiro)

I am studying the effects of habitat fragmentation on food webs involving bats, insects and plants. I use DNA barcoding and NGS to document the relationship among these groups in a fragmented landscape in the Atlantic Forest of SE Brazil. I also perform occupancy modeling and functional and phylogenetic trait analysis and in collaboration we are assessing microbial diversity of the system.



Omar Khalilur Rahman (BSc Imperial, MSc Queen Mary)

I am studying how host-parasite relationships are affected by habitat fragmentation using bats and their ectoparasites as a model. I am also developing a novel protocol for metabarcoding eDNA in the field. This research will hopefully help us understand how to better protect biodiversity but make future research documenting interactions more rapid.



Rosie Drinkwater (BSc Edinburgh, MSc Imperial)

I am studying mammal diversity in degraded forests in Borneo as part of one of the world's largest experiments in deforestation. I use high throughput sequencing analysis of blood meals in leeches as a non-invasive mammal monitoring method. I am also comparing the relative efficiency of using brown and tiger leeches as the DNA source.



PI: Dr. Elizabeth Clare

My research considers biodiversity at all levels from molecular evolution to ecosystem function and food web structure. I employ novel genomic techniques to focus on the evolution and recognition of species, the connections between species and trophic levels. The evolution of trophic interactions has many repercussions for conservation. I track food webs in both tropical and temperate systems and to investigate ecosystem functioning and evolution.

I have constructed and compared food webs among frugivores, insectivores and pollinators in both temperate and tropical environments and work in many countries including Canada, the US, Jamaica, Costa Rica, Belize and the UK. My lab members work in additional areas around the world.

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